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AUTHOR Fisher, Charles W.; And Others
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ABSTRACT

This executive summary of the multiyear Beginning Teacher Evaluation Study (BTES) focuses principally on the findings of Phase III-B of this research program on teaching effectiveness. One outcome of the BTES study was a concept that makes it possible to measure individual student learning by noting observable variables of student behavior in the classroom. Academic Learning Time (ALT), as the concept is called, is defined as the amount of time a student spends attending to academic tasks while also performing with a high success rate. The more ALT a student accumulates, the more he or she can be assumed to be learning. The study also revealed five general interrelated components of effective teaching: diagnosis, prescription, presentation, monitoring, and feedback. Teachers who pay attention to all these factors tend to have students who accumulate high rates of ALT. Two other variables that are correlated with effective teaching emerged from the study. One was academic orientation, or the extent to which the teacher emphasized, valued, and worked toward cognitive achievement. The other was orientation toward affect, or the extent to which the teacher was aware of, acknowledged, and valued student feelings. (Author/JM)

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# Teaching and Learning in the Elementary School: A Summary of the Beginning Teacher Evaluation Study

Charles W. Fisher
David C. Berliner
Nikola N. Filby
Richard Marliave
Leonard S. Cahen
Marilyn M. Dishaw
Jeffrey E. Moore

Report VII-1 September, 1978

# PREFACE

This report summarizes a multi-year research program on teaching effectiveness in basic skills at the elementary school level. The research program is referred to as the Beginning Teacher Evaluation Study (BTES). The BTES was sponsored by the California Commission for Teacher Preparation and Licensing (CCTPL) with funds provided by the National Institute of Education (NIE). The CCTPL initiated this research program in 1972 in the belief that sponsorship and encouragement of basic research on teaching and learning will lead to improvements in teacher training and therefore, will enhance the day-to-day educational experiences of children. The CCTPL, which has a large number of responsibilities concerning the training and licensure of teachers in California, has maintained its commitment to this belief. The BTES has been supervised by the Research and Planning Committee of the CCTPL. Throughout the study, the Committee members and CCTPL staff have made substantial contributions to the work.

The research program was carried out in three sequential Phases. Phase I (1972-73) was a planning year. Phase II (1973-74) included a large field study for the development of instrumentation and generation of hypotheses. Phase II was carried out by a team of researchers at the Educational Testing Service headed by Dr. Frederick J. McDonald. Phase III (1974-78) consisted of a series of field studies which were designed and conducted by the Far West Laboratory for Educational Research and Development.

This summary focuses on the results of the final phase of the BTES, which in turn, drew upon earlier BTES work and many other research studies. This document draws most heavily from approximately three dozen technical reports

produced by the Far West Laboratory for Educational Research and Development during Phase III-B of the BTES.

Although the title of the research program specifies "beginning" teachers, it is important to note that the empirical work was carried out in classrooms where teachers had several years of teaching experience. Therefore, the results of the study are based upon information from experienced teachers.

We acknowledge the contributions of the dozens of colleagues who have been associated with this research program. We are especially grateful to the dozens of school districts, hundreds of teachers and thousands of students in California schools who have participated in various phases of the study. The study was only possible because hundreds of teachers selflessly gave our research staff hundreds of hours of their valuable time. Their professional contributions to the advancement of knowledge about classroom teaching and learning cannot be praised enough. We are grateful for what they taught us.

Charles W. Fisher
David C. Berliner
Nikola N. Filby
Richard Marliave
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Marilyn M. Dishaw
Jeffrey E. Moore

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The purpose of the Beginning Teacher Evaluation Study (BTES) was to identify classroom conditions and teaching activities that foster student learning in elementary schools. The study focused on instruction in reading and mathematics in grade two and grade five. Over the five-year course of the study, data from several samples of teachers and students were collected and analyzed. As the study progressed, a model of classroom instruction and student learning evolved. This model provided the conceptual framework that guided the final stages of the study and presents a useful way to integrate the findings. The development of the model is, in itself, one of the more important outcomes of the study.

This summary report[1] presents a description of the model, the major findings of the study, and implications of the study for the practice of teaching.

## A MODEL OF CLASSROOM INSTRUCTION

This model of classroom instruction states that, for a given student, certain instructional processes lead to student classroom learning, which is then reflected in achievement test scores (see Figure 1). In this model, student aptitudes have a direct impact on both student classroom learning and achievement test scores.

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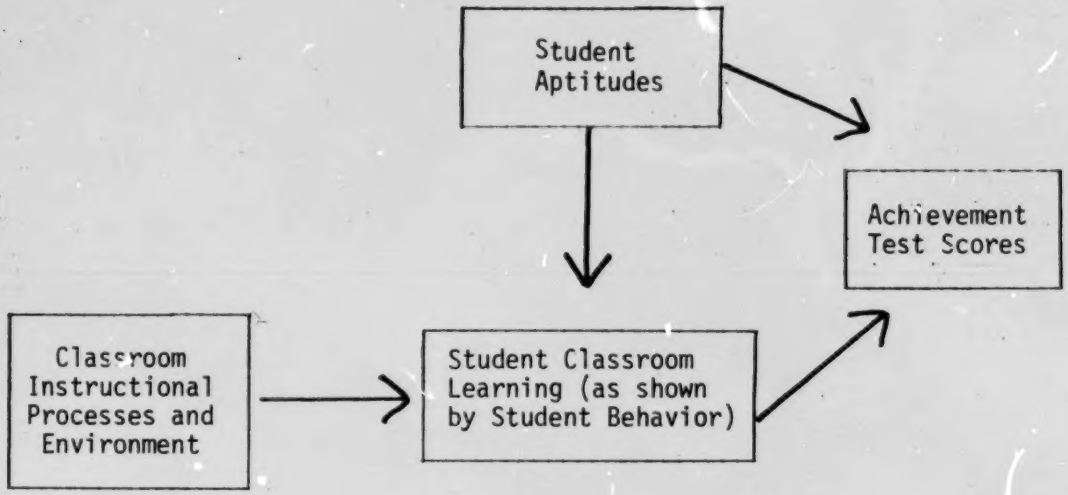
[1] This summary draws upon approximately three dozen technical reports and notes which document various aspects of the BTES. An annotated bibliography of technical reports and instructions for ordering the reports are available from the California Commission for Teacher Preparation and Licensing, 1020 "O" Street, Sacramento, California 95814.

Figure 1

A Model of Classroom Instruction


Student Aptitudes
Achievement Test Scores
Classroom Instructional Processes and Environment
Student Classroom Learning (as shown by Student Behavior)

The important thing about this general model is that it distinguishes between student classroom learning and student achievement test scores. Achievement test scores are frequently used to measure learning. Test scores are one useful indicator of learning but they are not learning itself. Learning takes place over time in the mind of the student. The BTES model implies that learning can also be measured more directly and immediately by looking at student behavior in the classroom.

Academic Learning Time (ALT)

The central element in Figure 1 is student classroom learning. In BTES we developed a measure of student classroom learning using observable student behavior. This measure of student learning is called "Academic Learning Time" (ALT). Academic Learning Time is defined as the amount of time a student spends engaged in an academic task that the student can perform with high success. The more ALT a student accumulates, the more the student is learning.

An observable measure of student classroom learning is the amount of time students spend working on school tasks. For example, in second grade mathematics it is common to teach addition. For each pupil, a certain portion of the school day is typically set aside for work on addition problems. This block of time constitutes the maximum time available for the student to work on addition. We refer to this quantity as time allocated to addition.

For some of the allocated time, the student will be actively engaged in work on addition, that is, s/he will be paying attention to the academic task. For some of the time, the student will be off-task, or unengaged. Since a student can only learn when s/he is paying attention, a measure of learning time should include only time when the student is engaged. Hence, engaged time represents a somewhat more refined measure of student classroom learning than allocated time. It includes that part of allocated time during which the student is paying attention.

The difficulty of the task for the student will also influence the amount learned. If the task is very difficult and the student produces few correct responses during the task, then the activity will not yield much learning for that student. On the other hand, if the student produces many correct responses on the task, then we hypothesize that learning is occurring. In this study, task difficulty for the student was measured in terms of student success rate.

Success rate, as used in this model, is a complex concept that warrants some elaboration. It is intended to reflect the degree to which the students correctly understand the instructional tasks they have been assigned. A given student will learn more from some tasks than from others. Hence there are degrees of task appropriateness for the student.

Success rate is intended to reflect the appropriateness of the task for the student working on it.

Three broad levels of success on a task were identified. High success describes situations where the student has a good grasp of the task and only makes occasional careless errors. If a student does not understand the task and makes correct responses at about the chance level, then this situation is labelled low success. Situations that fall between low and high success are defined as medium success. Medium success involves a situation of partial understanding, where the student understands enough to produce some correct responses, but also commits errors due to limitations in his/her understanding of the task.

The ALT model proposes that more time spent working with high success leads to increased achievement. However, this does not necessarily imply that all of a student's time should be spent in the high success condition. If all of a child's tasks are so easy that s/he is never challenged with new material, then little new learning is likely to occur. Generally, it is expected that some balance between high and medium success tasks, with somewhat more activities at a high success level, will produce the most student learning. Low success tasks would always be detrimental to learning.

To summarize, time spent by a student engaged on a task that s/he can perform with high success and where the task is directly relevant to an academic outcome, constitutes a measure of student classroom learning. We refer to time spent under these conditions as Academic Learning Time (ALT). The basic components of ALT are allocated time, student engagement, and student success rate. The ALT model implies that the accumulation of Academic Learning Time will lead to gains in achievement.

The absence of Academic Learning Time is also important. A great deal of student time in class consists of non-ALT, either because the student is not engaged in any academic task or because the academic task in which the student is engaged provides an inappropriate success rate. The usefullness of the non-ALT concept lies in the specification of its cause: either lack of engagement or an inappropriate success rate. Hence, it is possible to analyze, in terms of student behavior, why learning does not occur.

## Instructional Processes

The teaching behaviors that influence student learning can be conceptualized as serving five interrelated functions. These are diagnosis, prescription, presentation, monitoring, and feedback. These functions occur through time in a roughly cyclical fashion, as shown in Figure 2.

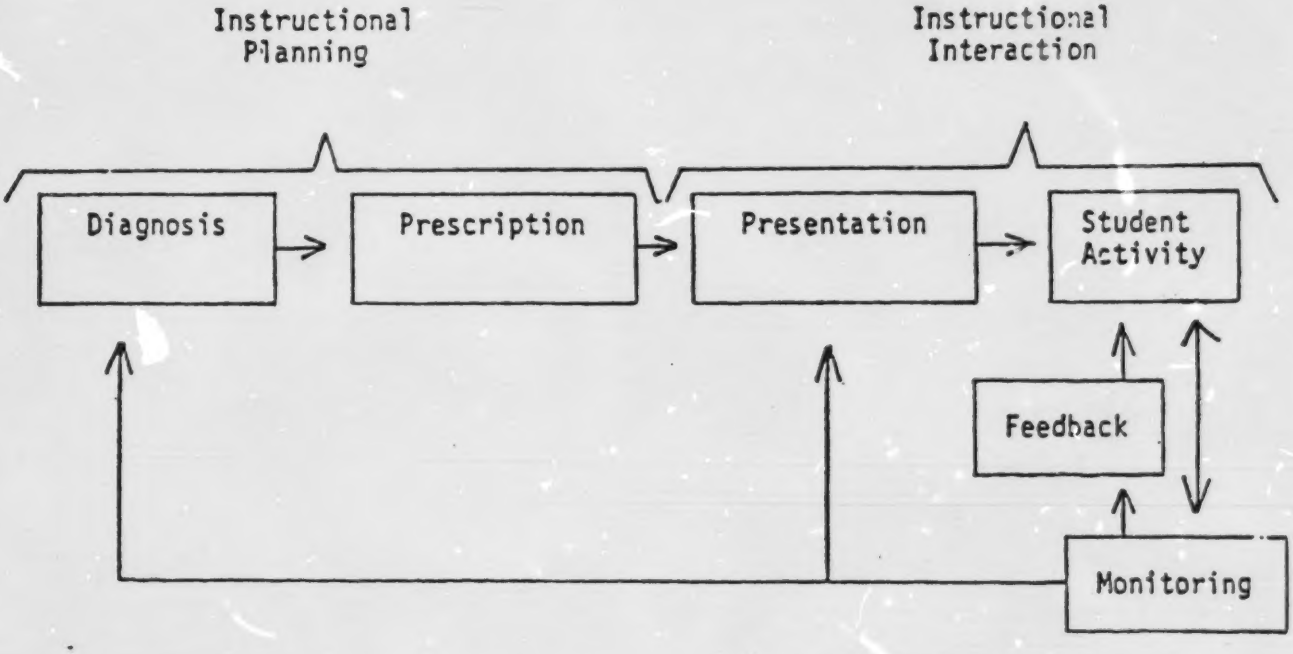



Figure 2

Instructional Functions in the Academic Learning Time Model of Classroom Instruction

The cycle of functions begins with a planning phase. The teacher as organizer and decision-maker assesses the current knowledge, skill levels, strengths and weaknesses of the student (diagnosis). S/he can then decide on appropriate instructional goals and activities, grouping and scheduling (prescription). These decisions set the stage for the interaction phase.

The interaction phase begins with the presentation of concepts or learning tasks to the student. The student responds to this input in some way, either with an overt action, with a covert assimilation of information, or by ignoring the input. The teacher monitors the student's responses in order to know whether the instructional goal is being achieved. Monitoring tells the teacher about the student's state of knowledge or skill during and following an instructional activity. Guided by information from monitoring, the teacher may provide feedback to the student, provide additional explanation or cycle back to the beginning for further diagnosis and prescription.

If is important to realize that each of these functions can be fulfilled by a wide range of different specific behaviors, depending on the classroom organization, the cirriculum, or teacher preferences. Within the domain of diagnosis would be activities like giving formal tests, listening to a child read, talking to a child about what s/he is interested in, watching the way a student works during an independent seatwork assignment, etc. What all of these activities have in common is that they give the teacher information about the student. In BTES we usually did not study the effectiveness of different behaviors within each function. We did not look for the best way to do diagnosis. Instead we looked more generally at whether or not these functions were fulfilled. We looked at whether the teacher knew the skills levels of

individual students and whether s/he used that information to make reasonable prescriptions. We looked at how often the teacher made presentations monitored and gave feedback. The model implies that it is important for these functions to be fulfilled, but that there are many acceptable ways to do so.

Classroom Environment

Classroom environment plays an important role in instruction. The functional model of teaching processes depicted in Figure 2 operates within particular classroom environments. Classes may differ widely on such dimensions as enthusiasm, warmth, competitiveness, cooperation, and task orientation. Differences in environmental variables or classroom context variables may influence Academic Learning Time directly. For example, some teachers may value academic pursuits very highly and hence provide a classroom environment that has high academic press. This press may tend to raise the general level of engagement in the classroom.

Differences in environmental variables may also affect the relationship between teaching process variables and facets of Academic Learning Time. For example, the specific behaviors which constitute feedback might be very different in classrooms where the climate differs in warmth. The behaviors themselves might change or they might be interpreted differently by students. The difference in warmth would then affect the relationship between feedback and student engagement.

Summary

Academic Learning Time is an observable measure of ongoing student learning in the classroom. The BTES model of instruction states that the accumulation of Academic Learning Time represents learning taking place

place and therefore results in increased student achievement. The model also states that teaching behaviors have an impact on student achievement by influencing the facets of Academic Learning Time (time allocation, engagement rates, and success rates). In the model, teaching behaviors are categorized according to the instructional function they fulfill--diagnosis, prescription, presentation, monitoring, or feedback. These functions occur in a cyclical pattern during instruction and each function may be fulfilled by a number of different behaviors. The model also recognizes the impact of student aptitude and classroom environment on student learning.

## FINDINGS

The Beginning Teacher Evaluation Study culminated in an extensive examination of the Academic Learning Time model. Data on teaching behaviors, classroom environment, student Academic Learning Time and student achievement were collected. Data were collected in regular elementary school classrooms over a one-year period. Twenty-five second grade classes and twenty-one fifth grade classes participated.

Fourteen major findings from this field study are reported. Findings are organized into two groups. The first set of findings report relationships between Academic Learning Time and student achievement. The second set covers teaching processes and classroom environment in relationship to student learning.

### Academic Learning Time and Student Achievement

1. The amount of time that teachers allocate to instruction in a particular curriculum content area is positively associated with learning in that content area.

Teachers who allocate more time to a particular content area of the

curriculum have students who achieve at higher levels than teachers who allocate less time to that content area. Very large differences in time allocation were observed between classes. For example, the average amount of time allocated to mathematics in second grade classes varied from around 25 minutes per day in one class to around 60 minutes per day in another class. In fifth grade reading and reading-related instruction, the average amount of allocated time was found to vary from about 60 minutes per day in some classes, to about 140 minutes per day in other classes.

Within reading and mathematics, classes differed in the amount of time allocated to different skill areas. For example, in one second grade class the average student received nine minutes of instruction over the whole school year in the arithmetic associated with the use of money. This figure can be contrasted with classes where the average second grader was allocated 315 minutes per school year in the curriculum content area of money. As another example, in the fifth grade some classes received less than 1000 minutes of instruction in reading comprehension for the school year (about 10 minutes per day). This figure may be contrasted with classes where the average student was allocated almost 5000 minutes of instruction related to comprehension during the school year (about 50 minutes per day).

The differences in time allocations at the level of specific content areas, or at the overall level, are substantial. And these differences in how teachers allocate time are related to differences in student learning. Other things being equal, the more time allocated to a content area, the higher the academic achievement.

2. The proportion of allocated time that students are engaged is positively associated with learning.

Allocated time sets an upper bound on the amount of learning time a student will have. Within the reading period, students will be actually paying attention to the task only part of the time. The percentage of the time that students are engaged is related to learning. Students who pay attention more learn more.

This basic fact is not very startling. Without attention, little can be learned. However, the data reveal that the average rate of engagement varies widely across classes and across individual students. For example, during reading and mathematics instruction there were classes that had an average engagement rate of about 50 percent. This means that during reading instruction students were attending to their work only half of the time. In other classes, the average engagement rate approached 90 percent. In other words, two classes might allocate the same amount of time to reading instruction, but one class might have almost twice as much real engaged learning time as the other. Since engagement rate has been shown to be highly variable across classes, and that variability has been empirically related to achievement, it is possible that increasing engagement rates will lead to increased achievement.

3. The proportion of time that reading or mathematics tasks provide a high success rate for a student is positively associated with student learning.

Three rather broad categories were used in this study to define the difficulty level of the material or activities that were worked on by students. One was "high success," the student understands the task and makes only occasional careless errors. One was "medium success," the student has partial understanding but makes some substantive errors. One was "low success," the student does not understand the task at all. These categories coincide with common sense notions of "easy," "medium," and "hard."

Our findings consistently point out the positive effects of school tasks yielding high success rates (easy materials, providing a low error rate). Other research on instructional design has stressed the importance of high success rates. High success rate in scholastic activities has also been found to be one of the factors that contribute to high levels of student self-esteem.

The average student in the BTES study spent about half the time working on tasks that provided high success. In grade five mathematics, the average was somewhat less. Students who spent more time than the average in high success activities had higher achievement scores in the spring, better retention of learning over the summer, and more positive attitudes toward school. Thus, we recommend that students spend somewhat more than half their time on tasks they can carry out with high success. Sixty or seventy percent might be reasonable.

The idea of success rate may be more understandable if one thinks about the cyclical nature of learning. Learning is a process of moving from not knowing to knowing. Most likely, when new material is introduced the student will not understand completely and will make some errors. Guided practice and/or explanation help the student understand, and s/he comes to make fewer errors. Eventually, the student will perform correctly, although probably with some effort. Learning will become well established and further work will be practice or review. This stage could be viewed as one of consolidation. At some later point, the student knows the material so well that further practice is of minimal value and it is time to move on to something new. BTES results suggest that for learning of basic skills in the elementary grades, the stage of <u>successful practice</u> (consolidation) is particularly important, so that concepts and procedures are thoroughly mastered. Apparently some teachers do not devote sufficient time to this

stage.

While we have emphasized the importance of giving students ample opportunity for successful practice, we must point out that it would not be desirable for students to spend all their time on tasks they can perform completely correctly. Common sense suggests that too high a rate of "high success" work would be deleterious (boring, repetitive, time wasting, etc.) Probably, some balance between "high success" and more challenging work is appropriate. Also, we found in BTES that older students and/or students who were generally skilled at school learning benefited from a smaller percentage of time at the high success level. Apparently these students had learned to problem solve, to take a task they did not completely understand and work it out. These students may enjoy the challenge of more difficult material, as long as they eventually experience success.

4. The proportion of time that reading or mathematics tasks provide a low success rate for a student is negatively associated with student learning.

When students worked with materials or activities that were categorized as "hard," yielding a low success rate, achievement was lower. In this study, no teacher assigned a high proportion of materials that were exceptionally hard for students. However, some students worked on materials judged to be excessively difficult for them as much as 20 percent of the time. Other students never worked at a low success rate. Students who were observed to spend more time on excessively difficult material generally learned less than other students. It is seldom, if ever, desirable for students to be given tasks where they experience low success.

5. Increases in Academic Learning Time are <u>not</u> associated with decreases in attitude toward mathematics, attitude toward reading, or attitude toward school.

The data from this study revealed that students with high and low rates of allocated and engaged time were equally likely to have positive or negative attitudes toward the subject matter and the school. Educators are naturally concerned about whether greater than average time in academic pursuits or greater than average rates of attending will result in negative attitudes. In the current study, that did not happen. There is one consistent, positive trend in the data. It appears that students experiencing high rates of success are somewhat more likely to have a positive attitude toward reading, mathematics, and school.

Summary. The first five findings are concerned with measures of ongoing student learning (Academic Learning Time) and their association with student achievement. Academic Learning Time is an important predictor of student achievement. Allocated time, engagement rate and success rate of school activities are all associated with student achievement. Students who accumulate more Academic Learning Time generally have high scores on achievement tests. This means that Academic Learning Time can be interpreted as an immediate, ongoing measure of student learning. Students do not generally develop negative attitudes when they have large amounts of Academic Learning Time, and success may contribute to positive attitudes.

## Instructional Processes and Classroom Environment

Both student achievement and Academic Learning Time are measures of student learning. The next question is, "What impact do teaching behaviors and characteristics of the classroom environment have on student learning?" Student achievement, engagement rate and success rate were all used as

measures of aspects of learning. Measures of the five teaching functions and of classroom environment were related to these outcome measures. This section reports major findings.

6. The teacher's ability to diagnose student skill levels is related to student achievement and Academic Learning Time.

Teachers were asked to predict how their students would do on certain test items used in the achievement battery. This ability to predict student performance was used as a measure of the teacher's diagnostic ability. A positive relationship was found between a teacher's diagnostic ability and the reading and mathematics achievement of students. Diagnostic ability probably relates to student achievement by working, in part, through student Academic Learning Time. The teacher's diagnostic ability was negatively related to low success rate (that is, the better the teacher was as a diagnostician, the less likely s/he was to prescribe materials that were extremely difficult). The diagnostic ability of the teacher was also positively related to student engagement. Among teachers in this sample, the better diagnosticians generally had students who showed higher rates of engagement. The evidence, while not always consistent, suggests that improving the teacher's ability to make accurate assessments of student performance would have positive effects.

7. The teacher's ability to prescribe appropriate tasks is related to student achievement and student success rate.

The classroom observers in this study rated the "appropriateness" of instruction in the classes they examined. In making these ratings, they were asked to think about how reasonable the instruction was for those particular students. That is, does instruction generally match the needs and skill levels of individual children. This rating of

appropriateness was generally positively related to achievement. Appropriateness in prescribing learning activities probably relates to student achievement partly because of the relationship between appropriateness and Academic Learning Time. Appropriateness of prescription was related to the proportion of time students had low success on their work. Higher ratings of appropriateness were always associated with less frequent occurrences of very hard material.

8. More substantive interaction between the student and an instructor is associated with higher levels of student engagement.

Substantive interaction between teachers and students consisted of presentation of information on academic content, monitoring of work, and feedback about performance. Most student-teacher interaction took place in a group setting, with only a small part of such interaction occurring during seatwork as one-to-one "tutoring". Students who spent more time in a group setting had higher rates of engagement. When group time was characterized by high levels of substantive interaction (as opposed to organizational tasks or waiting for others), then engagement rates were higher during groupwork and during seatwork. When students received more contact with an instructor during seatwork, then engagement rates were higher in seatwork. Engagement rates were especially low when students spent two-thirds or more of their time in seatwork and had little interaction with an instructor. The use of aides, parent volunteers, cross-age tutors and peer tutors increases the amount of interactive instruction and can be presumed, therefore, to keep engagement rates higher. Thus this finding has implications for class size, individualized instruction, use of aides, and grouping practices. Those allocations of resources and

those organizational arrangements that allow for more substantive interaction between adult and student will be preferred because of the positive association of substantive interaction with student engagement.

9. Academic feedback is positively associated with student learning.

Academic feedback was defined as information given to the student about whether his answers were right or wrong. Many different specific behaviors were conceptualized as fulfilling this function, including answering questions in class, checking papers, programmed text, and oral reading. The percentage of instructional time during which the student received feedback was positively related to student engagement rate and to achievement. Hence more academic feedback leads to higher engagement and achievement.

10. Structuring of the lesson and giving directions on task procedures were positively associated with student success rate.

Teachers who gave directions more often and spent time discussing the structure of the lesson had students who showed a higher success rate. Anecdotal reports suggest that students sometimes do not know what they are supposed to be doing or how they are supposed to mark a particular worksheet. Clarifying activities by the teacher can help raise student achievement by affecting the "success rate" component of Academic Learning Time.

11. Explanation specifically in response to student need is negatively associated with student success rate.

One teaching behavior was explanation in response to student need. This occurred when a student did not understand something and the teacher explained it to him. Most explanation-need occurred during seatwork. Students who received more explanation in response to need tended to have

fewer high success tasks and more low success tasks. One way to say this is that a student who had more need received more explanation in response to need. Apparently, though, the explanation did not solve the problem, since, in the long run, the student had a low success rate. Frequent need for explanation may be a signal that changes are needed in the student's instructional program.

12. More frequent reprimands for inappropriate behavior are negatively associated with student learning.

One teaching behavior observed in BTES was "task engagement feedback," information given to the student about whether his behavior was acceptable or unacceptable. Usually task engagement feedback amounted to a "reminder" to the student to get back to work. Such reminders were given more often to students who were off-task more often. They were also given more often to students for whom some tasks were excessively hard. It may be that some students are sometimes unable to do tasks they have been assigned, so they do not work, and the teacher then reprimands them for not working. Students who received more frequent reprimands also tended to show less growth on achievement tests. It is hard to imagine teaching without reminding students of the rules for acceptable behavior. However, the need for frequent reminders may be a sign of trouble.

13. The teacher's value system is related to Academic Learning Time and to student achievement. Teacher emphasis on academic goals is positively associated with student learning.

Classes judged to have high emphasis on academic performance typically showed high levels of achievement. More of the unusually high-achieving classes, as opposed to the unusually low-achieving classes, had teachers characterized by a strong academic orientation. These classes were not necessarily "cold" or unconcerned with student feelings. They

did, however, emphasize the importance of school learning In contrast, some classes were primarily oriented toward affective outcomes, such as student attitudes and feelings. When the teacher was primarily oriented toward affect, then less time was allocated to academic instruction, student engagement rates were lower, students were more likely to be given low-success tasks, and student achievement was therefore lower. Nothing in these data suggests that classes should be free of affect -- quite the contrary. But the evidence is clear that when teacher attention to academic instruction is substantially reduced, students achieve less.

14. A learning environment characterized by student responsibility for academic work and by cooperation on academic tasks is associated with higher achievement.

In classes where students took responsibility for their classwork and belongings, and where students helped each other, shared materials, and worked together, achievement was generally higher. Descriptions of specific classes indicated that this relationship held most often when there was a high level of academic focus in the classroom. Where students worked together to reach academic goals and where they took responsibility for achieving them, then achievement was higher. Cooperation and student responsibility in nonacademic pursuits did not have this effect.

## IMPLICATIONS

In this section of the report we go beyond the major findings of the study and discuss possible implications. Our goal is to underline those issues which we believe to be important for elementary education and to provide an integration of the findings which combine objective results with belief based upon our experience. In most cases, strong inferences must be made in translating the findings into statements which can be applied to elementary school teachers and students in general.

Academic Learning Time and Achievement

A major finding of the study is that increases in Academic Learning Time are associated with increases in student achievement. The practical importance of Academic Learning Time in relationship to achievement is illustrated in Table 1, using examples from our analysis of grade two reading instruction. This table displays total reading scores in October, student engaged time with a high success rate (Academic Learning Time) in reading over the period from October to December, and estimated total reading scores in December. The reading scores in December are estimated from linear regressions that use the test scores in October and the intervening Academic Learning Time to estimate the expected December test scores. Total reading scores in October and December are shown both in terms of raw scores out of 100 items (percent of items correct) and in terms of percentile rank among students in this study. Student engaged time with a high success rate (Academic Learning Time) in reading is shown both in terms of total time over the five week intertest period and in terms of the corresponding average daily time (in minutes).

Reading across the rows in this table from left to right, one can see that given a particular reading score in October (two left columns) and a particular amount of Academic Learning Time (middle two columns), what the estimated reading score in December is (two right columns). It should be recognized, however, that students who started with a given score in October and experienced a given amount of Academic Learning Time during the intervening period did not always attain the same score in December. Therefore, it was necessary, for the purposes of this table, to arrive at some estimate of a "typical" or expected score in December, given certain initial scores and some amount of Academic Learning Time. In Table 1, the estimated December raw

Table 1

Academic Learning Time and Student Achievement:

Examples from Grade 2 Reading Based on
BTES (Phase III-B) Results
(A-B Period)

| Reading Score at A (October) | | Student Engaged Time in Reading with High Success Rate | | Estimated Reading Score at B (December) | |
|---|---|---|---|---|---|
| Raw Score (out of 100) | Percentile | Total Time Over 5 Weeks (Minutes) | Average Daily Time (Minutes) | Raw Score (out of 100) | Percentile |
| 36 | 50 | 100 | 4 | 37 | 39 |
| 36 | 50 | 573 | 23 | 43 | 50 |
| 36 | 50 | 1300 | 52 | 52 | 66 |
| 16 | 17 | 100 | 4 | 20 | 15 |
| 16 | 17 | 573 | 23 | 25 | 21 |
| 16 | 17 | 1300 | 52 | 35 | 36 |

Notes:

1. An average of 25 school days occurred between the A and B testing.
2. The B reading scores are estimated via linear regression.
3. The values of all variables in this table are within the ranges actually obtained in the BTES sample.
4. The average engaged time with high success rate in grade 2 reading for the A-B period was 573 minutes.

scores have a standard error of 11.4. This indicates that two-thirds of the pupils with an estimated score of, say, 40, will have scores between 28.6 and 51.4.

Table 1 shows that substantial increases in Academic Learning Time are associated with important increases in achievement. Consider the student who started the period with a grade two reading score that was average (50th percentile, see the top three rows). If this student experiences the average amount of Academic Learning Time (573 minutes total, or 23 minutes per day in reading), then the student can be expected to show average reading achievement in December (50th percentile again). Note also that the "average" student with "average" Academic Learning Time does show considerable learning in terms of predicted raw scores.

Table 1 also indicates that if this average student (in terms of October's test score) experienced only 4 minutes per day of Academic Learning Time (100 minutes total for the intertest period), then s/he would be expected to show almost no change in raw score (36 out of 100 correct in October, 37 out of 100 in December) and would decline considerably in relative terms (50th percentile in October, 39th percentile in December). However, if the same student experienced very large amounts of Academic Learning Time, 52 minutes per day in this example, then s/he could be expected to answer almost 50 percent more items correctly on the December test than on the October test (36 out of 100 correct in October, 52 out of 100 correct in December). Furthermore, in this situation the student would show considerable improvement in reading achievement relative to the other students in the study (50th percentile in October, 66th percentile in December). Thus, the student with large amounts of Academic Learning Time benefits substantially.

It may appear that this range from 4 to 52 minutes per day is unrealistically large. However, these values actually occurred in the classes in the study.

Furthermore, one can easily imagine how either 4 or 52 minutes per day of Academic Learning Time might come about. If 50 minutes of reading instruction per day is allocated to a student who pays attention only about a third of the time and only one-fourth of the student's reading time is at a high level of success, then the student will experience only about 4 minutes of engaged reading at a high success level. Similarly, if 100 minutes per day is allocated to reading for a student who pays attention 85 percent of the time, at a high level of success for almost two-thirds of that time, then s/he will experience about 52 minutes of Academic Learning Time per day.

In summary, large differences in Academic Learning Time are associated with very important changes in predicted achievement levels. These large differences in Academic Learning Time are well within the range that was actually observed for this study. In addition, one can easily imagine how these differences in Academic Learning Time could occur in realistic situations. Therefore, Academic Learning Time is shown to be of considerable practical importance in terms of its relationship to achievement.

## The Learning Student

The current definition of Academic Learning Time is time spent engaged in academic tasks that provide high success. This leads to the following view of what the "learning student" actually looks like.

First, s/he works on an academic task that is designed to result in increased knowledge or skills. The amount of time that the student spends in a given knowledge or skill area is directly and positively related to learning in the same area. Furthermore, this appears to be as true for the more conceptual knowledge areas as it is for the more basic skill areas. For example, comprehension skills are as highly related to time spent working on comprehension as are decoding skills to time in decoding. Therefore,

the learning student spends relatively great amounts of time working on tasks that are directly related to the subject matter to be learned.

The learning student is also very attentive. S/he is actively involved in the task at hand, probably with some enthusiasm. The learning student is busy performing the academic part of the task, rather than sharpening pencils, looking for a book, or waiting in line to ask the teacher a question. S/he is not "socializing" or daydreaming. Nevertheless, the student is enjoying the activity. Paying attention for relatively long periods of time does not upset the student. Furthermore, his/her success on the task makes this active involvement more enjoyable.

The learning student spends a lot of time practicing and reviewing skills. S/he undertakes an activity related to a new skill only after thoroughly learning skills prerequisite to the new skill, so that s/he virtually never encounters an activity that is really entirely "new." At a younger age and/or an earlier stage of education, the learning student spends relatively greater periods of time practicing and reviewing. As s/he advances academically, it becomes possible to reduce the proportion of time spent practicing and reviewing. There is always some need for consolidation of acquired skills (practice), but as the student advances, s/he actually "learns how to learn," so that it becomes easier to acquire newer skills without as long a period for consolidation of prerequisite skills. In addition, attempts to learn the newer skills probably serve to consolidate the previously acquired skills, insofar as the more advanced student is applying these acquired skills to the newer skill.

The need to spend relatively great amounts of time practicing and reviewing skills is probably partially a function of the fact that students are <u>not</u> constantly tutored. That is, students spend the majority of their time working independently or with only intermittent teacher contact. Students, particularly

less-advanced students, have difficulty acquiring new skills on their own, so they need to practice previously acquired skills when working alone. Therefore, as students become more advanced, they should not only be able to spend less time practicing and reviewing, but should also be able to spend more time working independently. This would explain the fact that some highly capable students learn quite well on their own, without instruction by a "teacher."

A conclusion of major importance is that this "learning student" is not necessarily an unhappy student. The learning student does not learn to dislike learning. Lots of hard work may sound undesirable to most people. However, we do not find any evidence that students are less satisfied when the sheer quantity of work (allocated time) is relatively great. Furthermore, we do not find that students who pay more attention (work intensively) acquire a distaste for learning. In fact, one could assume that when attention is the result of interest and enthusiasm, rather than coercion, then attention represents a more positive attitude toward learning. Recall that student engagement does not appear, generally, to be prodouced by the coercive demands of the teacher (negative task engagement feedback), as in "Get back to work."

It is interesting to note that the high-success component of learning is associated with more positive student attitudes. Successful students probably enjoy learning more because of their success. Failure, even when it is only occasional, appears to result in a more negative attitude among younger students. This may be less true, however, as students acquire more academic experience and become more accustomed to school.

We talk about what the learning student looks like because we hope that this will help teachers think about what they are trying to accomplish in the classroom. To some extent, the characteristics of the learning student are under the direct control of the teacher. Teachers make decisions about what

to teach and how much time to spend on a particular goal. The ALT model implies that these decisions are very important. Teachers should be aware of how much time is really being spent on different skill areas. Classroom time is limited, so teachers should be careful to spend time on those activities that they consider the most important. If some skills are particularly important for students, it would be reasonable to spend large amounts of time on those skills.

Student success rate is also largely under the direct control of the teacher. As teachers assign tasks to students, they should, try to match the task to the student's skill level so as to provide frequent high success. This strategy is particularly promising at earlier grades and for less advanced students. Note that there have been previous advocates of this approach (programmed learning and mastery learning). However, many teachers probably do not recognize the extent to which less advanced students need practice and review (see discussion of teaching processes, below). Teachers should always be careful to avoid giving a student a task which is extremely difficult.

Effective Teaching

Diagnosis. The data support the conclusion that diagnosis is an important part of effective teaching. Students learn more when teachers know more about what their individual students can and cannot do.

In this study, we were primarily interested in cognitive achievement. To foster cognitive achievement, it is important for the teacher to know the cognitive skills and level of performance of individual students. To measure this teacher skill, we asked teachers to predict how their students would do on representative items from the BTES test battery. Students learned more when their teachers were more accurate in predicting performance.

Teachers were more accurate in predicting cognitive performance when they

knew more about the subject matter area and when they attended to differences between students. To measure knowledge of subject matter, we asked teachers to label the skills being taught on student workbook pages. For instance, the teacher would need to distinguish between addition problems which required regrouping and those which did not. Presumably, knowledge of the terminology used in reading and mathematics allows the teacher to label critical aspects of performance, to know what makes one test item harder than another, to know whether or not students have had instruction on problems of that kind, and to know what it is that the student doesn't understand. Abstract knowledge is not enough, however. The teacher needs to see differences between students, to see that Johnny has understood the concept being taught but Mary hasn't. Teachers are aware of many kinds of differences between students--differences in cognitive performance, differences in personality, differences in work habits, etc. General perception of differences was not strongly related to achievement. This implies that some kinds of information about students are more useful than others in relationship to achievement. It may be particularly important to attend to differences in cognitive performance. When knowledge of subject matter and awareness of student differences are combined to give the teacher an understanding of what each student can and cannot do, then a foundation for instructional planning has been established.

In the BTES study, we did not systematically study how teachers who were good diagnosticians got their information. Interviews with teachers early in the year indicated that they used a variety of formal and informal assessment techniques. Some teachers gave commercially published tests; some had devised their own tests; some used special classroom activities designed to give the teacher information about what students could do. Teachers also had different ways of keeping in touch with student performance during the year. Presumably,

testing can provide an opportunity for monitoring progress and updating one's diagnosis. Perhpas more importantly, the student's responses to daily tasks provide an opportunity for informal evaluation. Examples of informal evaluation were evident in descriptions of high-achieving classes.

Prescription. Prescription refers to the process of deciding what students should work on in the classroom. This is a complex area and one with mixed results in the data.

The major positive factor in this area was the "appropriateness" of the instructional program for the needs of the students. This variable represents the integration of the two planning functions--diagnosis and prescription. It assesses the extent to which teachers use their knowledge of individual students to prescribe apparently reasonable instructional programs, matched to the needs of students. Appropriateness was related to success rate and to achievement.

Our measure of appropriateness was a rating made by trained field workers based on interviews and extensive observation. It is difficult to pinpoint exactly what was considered to be appropriate. The instructions on the rating form and supplementary comments by field workers provide some suggestions. Field workers were asked to consider the pacing of instruction, whether faster students could move ahead while slower students received extra help. They were asked to consider student success rate. They were given a hypothetical example of appropriateness--that the teacher might notice a student's interest in mathematical puzzles and bring in some additional materials that the student might be interested in. A hypothetical example of inappropriate instruction was: the teacher having all students in the same reading book regardless of clear

differences in reading skill. Field workers were asked to give the reasons for some of their ratings. The most salient dimension in second grade classes appeared to be flexibility of grouping. When noting instances of appropriateness, field workers often commented that the teacher would "regroup students according to needs" or that a student who was doing particularly well or particularly poorly was moved to another group. For grade five classes, this same dimension appeared, but field workers also seemed to attend to the overall organizational structure of the class. In grade two, most teachers had some form of small group instruction at least part of the time. In grade five there was more diversity. Some classes used whole class instruction; others had small group instruction; others had individualized programs where students worked independently. In grade five, individualized programs tended to get high ratings of appropriateness, since students were usually assigned tasks based on their individual test performance and could move ahead at their own rate. One fifth grade teacher was given a moderately high appropriateness rating for forming reading groups and then adapting the curriculum through the year to the level of performance, interest, and pace of each group.

One thing that should be clear from these examples is that the definition of "appropriate" is fairly broad and general. It assesses not whether each student was given the best instruction for his or her needs (something that would be impossible to determine) but instead whether the program appears to be reasonable for the different students in the class.

This description of appropriateness as reasonableness is consistent with the correlations we obtained between appropriateness and student

success rate. Classes where instruction was rated more appropriate had a smaller percentage of low-success tasks. In other words, it is generally unreasonable and inappropriate to give students tasks that they cannot do. At least, if tasks are too hard, either the curriculum or the grouping should change.

At the boundary between medium and high success, appropriateness is less clear. Based on BTES results, we would say that it is appropriate for students to spend over half their time on high-success tasks. The teachers in our study, even otherwise good teachers, did not always follow this advise. In grade five, classes rated high on appropriateness spent more time on medium-success tasks than on high-success tasks. This appeared to happen for two reasons. First, individualized programs were rated high on appropriateness. In these programs, students worked on their own and thus had to figure things out on their own. They were given tasks that they had not yet mastered but which they presumably had the necessary skills to figure out. As soon as they could perform the task correctly, they moved on to the next stage. In other words, there was relatively little review and practice at a high-success level in individualized programs. Second, some fifth-grade teachers who stressed academics tended to give moderately difficult work. These teachers emphasized academics, allocated large amounts of time to academics, provided competent instruction taking into account individual student performance levels, and expected a lot of students. In both cases, it is possible that the good features associated with appropriateness were offset by the limited amount of high success. One wonders whether students might not have learned more and been happier if the program had provided more high success.

The above discussion suggests that it may be useful to think of success rate itself as a prescription variable. Diagnosis followed by reasonable prescription will guide the teacher away from giving tasks that are too hard. Only a conscious and perhaps counterintuitive effort to provide high-success practice will produce more high succes experiences. Especially in the upper elementary grades, it seems imperative to work with teachers on experimental programs to determine the consequences of more high-success tasks.

Presentation. Presentation skills appear to be useful for increasing student engagement in mathematics. Teachers tend to explain concepts more often in mathematics than in reading. (The term "explain" is used broadly here. Demonstrating the steps involved in an addition problem would be considered explanation.) Students pay attention more in mathematics when they receive more frequent planned presentation of concepts in a group setting. They also pay attention more when the teacher spends time discussing the goals or structure of the lesson and/or giving directions about what the students are to do. Perhaps because of the tendency to give relatively more seatwork in math than in reading and because of the variety of problems to work, it is important that students know the context of the lesson and what they are to do, so that they become more involved in the task.

In both reading and math, students tend to make fewer errors on daily tasks when teachers spend more time structuring the lesson and giving directions. It may be that students make some errors because they don't understand the format of the page they are working on or don't recognize the skill they are supposed to apply. Student workbooks are notorious for their frequently changing formats and confusing directions. It seems critical that students understand what they are supposed to

do so that they can respond correctly.

Descriptions of particularly successful classes often mentioned that the teacher had a regular routine of beginning each lesson with a presentation in a group setting. The teacher would tell the students what they were going to work on, make sure all students understood the assignment, and go over examples where appropriate. The model math lesson used in a recent experimental study that showed positive effects began in a similar way. Thus, this seems like an efficient and productive procedure.

One kind of presentation was consistently associated with less high success and more low success. This was explanation-need, which is explanation of academic content specifically in response to student need. In effect, students who made more errors and did not understand classroom assignments received more explanation specifically in response to need. Students who needed help, got help. While this seems reasonable, one should be wary of overreliance on this teaching behavior. Explanation should increase understanding and increase the overall frequency of high success. In our classes, this did not happen. The danger is that explanation-need is too little, too late. Frequent use of explanation-need might best be interpreted as a symptom that the level or pacing of instruction are inappropriate for the student. Major changes may be in order.

Monitoring. A central teacher activity in the BTES model is monitoring, or keeping track of student progress on instructional tasks. The major form of monitoring that we observed was teacher questioning in a group setting. Teacher questions account for about one-third of the interactive, substantive instruction that takes place. Students pay attention more when they are more often involved in substantive

interaction, and teacher questions are an important part of that process. They involve the students in the interaction as well as giving the teacher information about what the students understand.

We did not examine the types of questions or pattern of questioning. Questions could be addressed to the group as a whole or to an individual student. The teacher could call on volunteers or go around the room in ordered turns. Presumably some types or patterns of questioning may be more effective than others for getting all students to respond in appropriate ways.

The term "monitoring" can also be used to refer to the teacher behavior of circulating around the room during seatwork checking on how students are doing. We found that a teacher rarely stops to observe a student's work without making some comment, such as providing feedback or explanation. When a student receives more attention from an instructor during seatwork (feedback or explanation), s/he pays attention more. Thus, it is a good idea to monitor seatwork by going around the room giving help or feedback as frequently as posisble. Descriptions of high-achieving classes suggest that good teachers do this not only to keep students on task, but also to find out as much as they can about how students are doing, so that they can plan further instruction.

Feedback. One particularly important teaching activity is providing feedback to students, letting them know whether their answers are right or wrong, or giving the right answer. Academic feedback to students should be provided as often as possible. When students receive more frequent feedback, they pay attention more and learn more.

Academic feedback as defined in the BTES observation system includes many different behaviors. We don't know at this point what

types of feedback may be more valuable than others. We can at least suggest some of the possibilities.

As defined in BTES, feedback is the major component in group interaction. Much classroom interaction follows a question-and-answer or recitation format: The teacher asks a question; a student answers the question. Presumably, when the teacher asks a question all students are supposed to think of an answer. When some student gives an answer orally, each student gets feedback on his or her own internal answer. So when a student gave an answer aloud, this was considered feedback to students listening to the answer. This kind of feedback probably accounts for a large part of the positive relationship between feedback and student engagement. That is, it may not be feedback per se, but feedback as part of substantive interactive instruction that increases engagement. When students spend more time in substantive interaction, including some explanation, teacher questions, student answers, student questions, teacher and student comments, then student engagement rates are higher. Substantive interaction serves as a motivator to get students involved in classroom activities.

The above discussion suggests that feedback may be one of several equally important parts of academic interaction, in terms of increasing student engagement. However, academic feedback had the strongest and most consistent positive relationship to achievement. This implies that there is something especially important about feedback. Many different forms of feedback (in addition to question-and-answer recitation) may contribute to learning.

Feedback can come from the curriculum materials rather than a human instructor. Programmed texts are organized to provide immediate feedback.

The curriculum also provides feedback when students check their answers in the back of the book or with an answer key. Feedback from the curriculum was not frequent in our classes, but it may be an important way to increase the amount of feedback students receive.

Non-credentialed instructors such as aides, volunteers and peers can provide feedback. To plan instruction, choose learning tasks, or explain concepts requires some skill as an instructor, and probably some training. But anyone who knows the answer to a problem can tell a student whether an answer is right or wrong, or give the answer to the student. Since an important part of learning is responding and receiving feedback, all classroom personnel should be used wherever possible to provide feedback.

Some classes that we observed had a regular routine on group assignments of meeting to check answers as a group. One fifth grade math class had regular homework assignments and spent the first part of each day going over the homework. Presumably, students are more likely to complete tasks when they know they will be held accountable. A routine of checking papers gives everyone regular feedback. Homework and checking homework were among the most consistently implemented parts of an experimental math program that proved to be effective.

Oral reading circle was a situation that we defined as involving high levels of feedback. Much like the recitation sequence, oral reading was considered feedback to a student who was reading along silently. The teacher might also correct errors, thus providing feedback to all students. This important purpose for oral reading should be kept in mind.

In addition to academic feedback, we also looked at task engagement feedback--feedback to the student about whether classroom behavior was acceptable or unacceptable. Most of the task engagement feedback we

observed turned out to be negative feedback, such as reminders to students to get back to work when they were off-task. We found no evidence that frequent use of such reprimands had any positive effect. It may be that some well-timed and well-phrased reminders are useful, but when task engagement feedback becomes frequent this is a sign that some structural changes are needed. There is an important lesson here for teachers who try to utilize BTES findings and work to increase student engagement: Scolding students more often is not the answer. Instead, one might 1) check to see that tasks are not too hard for the student (task engagement feedback was positively correlated with low-success rate), 2) increase the clarity and emphasis with which expectations are stated and the consistency with which students are held accountable, or 3) increase the amount of substantive interactive instruction.

A final comment comes from descriptions of high-achieving classes. Three high-achieving classes in our grade two sample were described in detail; and all three had some type of positive reward system--"bionic handshakes," ice-cream cones, teacher praise and/or tokens that could be used to get a prize. The concept seemed to be that good work deserved a reward. Such rewards were usually not frequent; but students had some sense, formal or informal, of what they had to do to get them. There seems to be value in reward systems which acknowledge major learning events; they give the student recognition for achievement, for working (perhaps working hard), and for succeeding.

Context. Schooling has many different purposes. One purpose is cognitive learning. Others might be: development of independent work habits, learning of social interaction skills, feeling good about oneself, enjoying work, appreciating the fine arts, or keeping students off the

street. Most teachers value and work toward a number of different outcomes. Because the BTES study focused primarily on cognitive outcomes, we cannot fully evaluate classroom instruction. Our data do point out, though, that choices must be made and that teachers should be aware of the choices they can and do make.

Two of the general variables in the BTES study had to do with the focus or orientation of the teacher. One was academic orientation--the extent to which the teacher emphasized, valued, and worked toward cognitive achievement. The other was orientation toward affect--the extent to which the teacher was aware of, acknowledged, and valued student feelings.

Examining these variables in relationship to student engagement and student achievement reinforced an old maxim: "First things first." If the goal is to maximize student learning of basic skills, then it is important that the teacher value this goal and be committed to achieving it. The teacher must be willing to allocate classroom time to academic instruction and must communicate to the students the belief that academic learning is important. The teacher must be willing to make a personal effort to reach this goal.

Descriptions of selected high-achieving classes illustrated this point. The high-achieving classes all had an emphasis on academics. In contrast, one teacher placed greater emphasis on nonacademic outcomes and devoted attention to music, personal development, and good feeling. There was little time spent on academics and achievement was low.

It seems reasonable to look for a middle ground. Many teachers give first priority to academic instruction but are also aware of student feelings and value human development. The high-achieving second

grade classes in our study show this to some extent. There are other good examples, in both grades, of teachers who make a sincere effort to provide competent academic instruction and also take into account student interests and human feelings. Often these classes are in the middle range of ALT and of achievement. The conflicting demands of different goals may tend to moderate achievement gain. For many people this is an acceptable compromise.

Another context variable, "learning environment," needs to be considered. This variable was a composite of two ratings--one on "cooperation," the other on "student responsibility." Especially in grade two, classes higher on learning environment tended to have higher achievement. Both components, cooperation and student responsibility, contributed to this effect. Students learned more when there was a spirit of cooperation and when students took responsibility for classroom activities. An examination of individual classes indicated that this effect depended upon cognitive focus. When students worked together to reach academic goals and when they took responsibility for achieving them, then achievement was higher. Cooperation and student responsibility in nonacademic pursuits did not have this effect.

One can construct from these results an image of an ideal class: there is a clear focus on cognitive learning; the students expect to work and are held responsible for doing so; the teacher cares about the students and wants to help them learn: teacher and students interact comfortably and frequently on work activities. In other words, a class where the teacher emphasizes the belief that the purpose of school is learning and fosters an environment where everyone, teacher and students, works together to reach that goal.

Implications for Teacher Education Programs

The basic product of the BTES is a model that provides a conceptual framework for examining student behaviors (Academic Learning Time) and teaching behaviors (the five teaching functions) at the elementary school level (grades two and five). The BTES did not examine the process of teacher education itself. Therefore, none of the research findings are directly relevant to that process. It is possible, however, to offer some suggestions for the application of the BTES model and related findings to programs of teacher education. These suggestions are based on our sense of what this model has to offer teachers.

Teaching is a complex process. The BTES model tries to deal with the reality of teaching. It is therefore a complex model. It is intended to provide a coherent, general framework for analyzing and describing the teaching-learning process. We think this makes the model more widely applicable to a variety of approaches to elementary school teaching; but it may mean that the model cannot be taught quickly and simply to teachers.

It would be appropriate to use the model as a basis for observing, analyzing, and discussing ways to teach. Prospective teachers might benefit from a chance to learn the concepts in the BTES model and use them for systematic observation in a variety of classes. A chance to watch the "learning student" would be particularly valuable, since teachers lose sight of the individual student learning process when they must manage an entire class. If different instructional approaches were observed, teacher trainees could analyze the different ways in which the five teaching functions of the model are (or are not) fulfilled. This process of learning and applying the BTES model would undoubtedly

take some time.

Teachers and teacher trainees studying the BTES model would have to understand it both as a framework for student behaviors, and as a framework for teacher behaviors. Academic Learning Time provides the student behavior framework. Since Academic Learning Time occurs simultaneously with instruction itself, it provides an individual student variable for assessing the impact of instruction. Therefore, Academic Learning Time is of potentially great value as an information tool to be used by teachers in the evaluation of their daily instruction. An awareness of the Academic Learning Time for an individual student, or the profile of Academic Learning Time across students in a class, may help a teacher decide when to intervene in an instructional sequence and what to change. This framework provides an observable in-class criterion that can even guide minute-to-minute instructional decisions.

The BTES framework for teacher (as opposed to student) behaviors categorizes these behaviors in terms of the general functions they serve in instruction. When specific teaching behaviors are analyzed at a molecular level, the impact of each behavior is unstable over even relatively small changes in context. The same behavior may serve different functions and different behaviors may serve the same function, depending on the context. This implies that there is no one specific behavior that will be essential to the performance of any given function.

This functional view of teaching behavior has considerable implication for the practice of teaching. Certainly teachers need a repertoire of specific teaching behaviors, but they must also have a good grasp of the functions that specific behaviors fulfill in a given context.

Teachers who are aware of teaching functions will be able to conceptualize their classroom behavior in terms of this more general framework. They will be able to evaluate what they are doing in terms of instructional functions that should be served. Furthermore, they will be able to recognize what they are not doing, in terms of functions that are not served by any of their usual behaviors. Hence, where Academic Learning Time provides a basis for determining when students are or are not learning, the five teaching functions provide a basis for analyzing the strengths and weaknesses of the instructional process.

Teaching as management - seeking a workable and dynamic balance. To apply the BTES model to typical classroom instruction, a broad view of teaching is needed; one that emphasizes the teacher's role as a manager of instruction. Furthermore, it must be recognized that this management role varies enormously as a function of the instructional situation. That is, to teach one student something, a teacher can learn about that student in depth, can work directly with the student on relevant tasks, can model desired behavior, give constant feedback, and provide timely and appropriate explanation. With a class of 26 students, however, this kind of one-to-one teaching is an infrequent luxury. Instead, the teacher must try to plan generally reasonable activities for the different students in the class and keep everything moving along as well as possible. The teacher cannot consider each student in isolation but must manage instruction for all students simultaneously. A dynamic balance between individual and group needs is required.

The BTES model can be thought of in terms of two competing goals. These are student engagement and student success rate. The data show that student engagement rates are higher when students have more contact with an instructor. Increasing the number of teaching personnel (aides,

volunteers, peer tutors, etc.) is a good way to increase the amount of interactive instruction a child receives. If the number of personnel (per pupil) is fixed, then the amount of interaction can only be increased through increasing the amount of group instruction. At the extreme, this means whole class instruction, which has the advantage of efficiency and ease of classroom behavior management. The teacher can give directions to everyone at once, keep an eye on what students are doing, monitor academic performance more easily, and give group feedback. This usually results in increased student engagement.

The problem with large group instruction is that the same task will seldom be appropriate for all students in the class, at least not for very long. The findings for student success rate, and related findings on diagnosis and prescription, show the importance of matching tasks to individual student needs. Especially for children low in entering knowledge or school learning skills, it is important that students have enough successful practice time to master the material. This means that the instructional program must, to some extent, provide different tasks for different students and allow different amounts of practice. "Individualized" programs emphasize the goal of appropriate instructional content and pacing for each individual. In the extreme, each student may be working on a different task at any one point in time. Therefore, the teacher cannot give directions or feedback efficiently in person, so these functions are usually built into the curriculum system. Some students may react to these independent seatwork settings and the lack of interactive contact by being less attentive.

Probably, for most classes and most teachers in the elementary grades, it will not be suitable to use one organizational pattern for the entire day. That is, constant whole-class instruction will probably not provide sifficiently appropriate content for all students. On the other hand,

constant independent seatwork in individualized programs will probably be too difficult to manage efficiently while maintaining engagement. Small group work is a useful compromise for individualizing content in a reasonable way, maintaining efficiency and engagement, and providing social experience. Even here, the same students will probably not fit in the same groups for all instructional content. Furthermore, it will not be possible for all students to spend all their time working in groups. The teacher must devise some workable system using different settings (groupwork-seatwork) for different students in different content areas at different times during the day, and keep the whole system adaptable to changes in student needs during the year.

In sum, the teacher must try to balance conflicting goals, taking into account the needs of the class as a whole, as well as the needs of individual students. There is no one "right" way to organize the instructional program. Different approaches have different assets and liabilities. By keeping in mind the joint goal of student attention and high student success rate, the teacher can evaluate the current organizational structure and adapt it over time.

## A Last Word

Student learning is an elusive phenomenon. Teachers work hard to encourage it. Students work hard to achieve it. Researchers work hard to measure it and to understand how it comes about. We believe that many students learn a lot in school, and that the BTES project helps explain that process so that some students can learn more. We believe that there is a real advantage to being able to measure student learning as it takes place in the classroom rather than through formal achievement testing. Academic Learning Time (ALT) represents one attempt

to measure ongoing student learning through observable classroom behavior. ALT has been studied as a measure of learning through its correlations with achievement. We hope that other people, especially teachers, will experiment with observation of students to get immediate feedback about the learning process. The teaching functions and context variables that we examined suggest important aspects of instruction that relate to student learning. Here, too, we hope the model will prove useful and will be refined as others apply it to the analysis of instruction. Most of these ideas are not new. None of them are consistently put into practice. We hope this model will help some people to steer a course toward more productive education for students.